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The relationship between geometry attitudes and self-efficacy beliefs towards geometry

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Abstract

The aim of this study was to investigate the relationship between geometry attitude scores and self-efficacy scores towards geometry. Thus, correlational model was used in the process of the study and convenience sampling method was used. The research was conducted with 126 pre-service elementary mathematics teachers studying at Aksaray University Education Faculty in 2010-2011 academic year. In investigating the relationship between geometry attitudes and self-efficacy beliefs about geometry “Self-efficacy scale towards geometry” developed by Cantürk-Günhan and Başer and “Geometry attitude scale” developed by Bindak were used. The results of the study revealed that, pre-service teachers’ geometry attitude scores and self-efficacy scores towards geometry is high. In addition, there is a strong positive relationship between pre-service teachers’ geometry attitudes and self-efficacy beliefs towards geometry.

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1. Introduction

Geometry is one of the most important branches of mathematics (Işıl & Ubuz, 2004) and it is concerned with the properties and relationships of lines, angles, curves and shapes, etc. Geometry helps us to describe and define the world systematically (Cantürk-Günhan & Başer, 2007). In addition, it helps us to acquire abilities such as making new discoveries, analyzing problems and making connections between mathematics and real life situations (Bindak, 2004). Plato’s quote “Let no man ignorant of geometry enter here” can be given as an example of importance given to geometry (Burton, 1999, p.79). Moreover, NCTM (2000) emphasized the importance of geometry in school mathematics by stating “geometry is a natural place for the development of students’ reasoning and justification skills” (p.40).

Although much effort is made in teaching geometry, numerous researches make it clear that students are not learning geometry as they are expected to learn (Clements & Battissa, 1992; Mitchelmore, 1997; NCTM, 1989; Senk, 1985; Thirumurthy, 2003; Ubuz, 1999). TIMSS 1999 has also reported that students’ geometry achievement have been found to be lower than the other areas of mathematics (Mullis, Martin, Gonzalez, Gregory, Garden,

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O'Connor, Chrostowski, & Smith, 2000). There are many factors affecting students' geometry achievement. While, Schoenfeld (1983) focused on the inadequacies of traditional teaching methods for the low achievement in geometry, Clements and Batista (1992) emphasized the need for teaching geometry concepts meaningfully and excitingly in overcoming the difficulties in this discipline. Besides, some researchers examined the effects of using technology such as computer programs on geometry achievement (Arcavi & Hadas, 2000; Baharvand, 2001; Choi-Koh, 1999). The above mentioned studies are all examples of cognitive factors that affect students' geometry achievement; however, affective factors such as attitudes and self-efficacy beliefs also have profound impact on students' geometry achievement. According to Bandura (1997) self-efficacy is a key concept in social learning theory and this concept is described as the self-decision of an individual in organising actions in order to be successful in a certain field (Bandura, 1997; Zimmerman, 1995). Bandura (1997) states four sources of self-efficacy. These are experiences like being successful or unsuccessful, emotional and physical conditions like fear, excitement, observing others' experiences, and witnessing the success and verbal convictions of family, friends and colleagues. Self-efficacy belief feeds on these sources and affects the performance, endeavour and the struggle of the individual (Küçükylmaz & Duban, 2006). Self-efficacy belief also affects individuals' thinking styles and emotional responses. Individuals with high self-efficacy levels can feel more relaxed and be more productive. Students confident in their social skills anticipate successful social encounters. Those confident in their academic skills expect high marks on exams and expect the quality of their work to reap personal and professional benefits. Individuals with low self-efficacy levels doubt their social skills and often envision rejection or ridicule even before they establish social contact. Those who lack confidence in their academic skills envision a low grade before they begin an examination or enroll in a course. Shortly, individuals with high self-efficacy levels will have social success or greater career options and the ones with low self-efficacy levels will have social isolation or curtailed academic possibilities (Pajares, 2002).

On the other hand, attitudes play an important role on students' geometry achievement. Philips (2003) defined attitude as a multi-faceted psychological construct based on an individuals' feelings, beliefs and values. Likewise, Thompson (1993) defined attitude as a learned pattern of manners that is developed through one's environment. It represents one's feelings towards a given circumstances and affects one's reaction to a particular situation. Attitudes towards mathematics include liking, enjoying, and interest in mathematics, or the opposite, and at worst math phobia (Ernest, 1989). In particular, Utley (2004) defined attitudes towards geometry as set of beliefs focusing on geometry that predisposes a person to respond in a certain way. Attitude is often considered in educational research since the development of a positive attitude is desirable because of its association with achievement (Nkwe, 1985). Ma and Kishor (1997) indicated there is a general belief that children learn more effectively when they are interested in what they learn and that they will achieve better in mathematics if they like mathematics. Similarly, if students have positive attitude towards geometry they are expected to like geometry, participate in the classroom activities and to be high achievers in geometry (Bindak, 2004).

A large body of research has dealt with students' attitudes in some areas (e.g., Bayram, 2004; Bindak, 2004; Duatepe, 2004; Fukuhsuser, 2002; Li, 2005; Randel, Stevenson & Witruk, 2000; Ubuz & Duatepe-Aksu, 2009). Similarly, a great deal of studies related with self-efficacy beliefs of students has been done so far (e.g., Cantürk-Günhan, B. & Başer, N., 2007; Saracoğlu & Yenice, 2009; Usher, 2009; Yenilmez & Uygan, 2010). However, studies examining the relationship between students' attitudes and self-efficacy beliefs are rather limited. Therefore, this study aimed to determine the relationship between geometry attitudes and self-efficacy beliefs of pre-service teachers.

2. Methods

2.1. Research Design

This study aimed to determine the relationship between pre-service students' geometry attitudes and self-efficacy beliefs towards geometry. Thus, the correlational model was used in the process of the study (Baştürk, 2009; Baykul, 1999; Fraenkel & Wallen, 2005; Karasar, 2005).

2.2. Sample

The study was conducted with pre-service elementary mathematics teachers studying at Aksaray University Education Faculty during 2010-2011 academic year. Convenience sampling method was used to determine the sample for this study. Of the 126 participants, 61 were boys and 65 were girls.

2.3. Instrument

In investigating the relationship between geometry attitudes and self-efficacy beliefs towards geometry, “Self-efficacy scale towards geometry” developed by Cantürk-Günhan and Başer (2007) and “Geometry attitude scale” developed by Bindak (2004) were used. The scale of Cantürk-Günhan and Başer (2007) consisted of 24 likert type items. The reliability of the scale was tested by its own developers and Cronbach alpha coefficient was found to be 0,90. The scale of Bindak (2004) consisted of 25 likert type items. The reliability of the scale was tested by its own developers and Cronbach alpha coefficient was found to be 0,94.

2.4. Data Analysis

Quantitative techniques were used in the analysis of data generated by geometry self-efficacy scale and attitude scale. In presenting the mean scores and standard deviations, descriptive statistics was used and in determining the pearson product-moment correlation between geometry self-efficacy scores and geometry attitude scores inferential statistics was used. Data were analysed by using the SPSS 15.0 statistics programme and presented in tables.

3. Findings

Descriptive statistics results regarding pre- service elementary mathematics teachers’ self-efficacy beliefs towards geometry are presented in Table 1.

Table 1. Descriptive statistics results regarding students’ self-efficacy beliefs towards geometry

Variable	N	Lowest score	Highest score	\bar{X}	S
Self-efficacy scores	126	55	116	100,41	13,12

Data presented in Table 1 reveals that students’ mean score and standard deviation values regarding self-efficacy scores was found to be 100,41 and 13,12 respectively. In addition, the lowest score and the highest score was found to be 55 and 116. These values show that, students’ self-efficacy beliefs regarding geometry correspond to “agree” category and this points out that students have positive self- efficacy beliefs towards geometry.

Descriptive statistics results regarding pre-service elementary mathematics teachers’ geometry attitudes presented in Table 2.

Table 2. Descriptive statistics results regarding students’ geometry attitudes

Variable	N	Lowest score	Highest score	\bar{X}	S
Attitude scores	126	45	121	88,71	12,80

Data presented in Table 2 reveals that students’ mean score and standard deviation values regarding geometry attitude scores was found to be 88,71 and 12,80 respectively. In addition, the lowest score and the highest score was found to be 45 and 121. These values show that, students’ geometry attitudes correspond to “often” category and this points out that students have positive attitudes towards geometry.

In order to examine the relationship between students’ geometry self-efficacy scores and geometry attitude scores pearson product- moment correlation coefficient was calculated. The results are presented in Table 3.

Table 3. Pearson product-moment correlations between geometry self-efficacy scores and geometry attitude scores

Variables	1	2
1. Self-efficacy scores	-	,709**
2. Attitude scores	,709**	-

** $p < ,001$ (2-tailed).

The relationship between geometry self-efficacy scores and geometry attitude scores was investigated by using pearson product-moment correlation coefficient. Preliminary analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was a strong positive correlation between the two variables, $r = ,709$, $n = 126$, $p < ,001$, with high levels of geometry self-efficacy associated with high levels of geometry attitude.

4. Conclusions and Recommendations

Cantürk-Günhan and Başer (2007) reported that students have positive self-efficacy beliefs towards geometry and Bindak (2004) found out that students have positive attitudes towards geometry. In the present study, pre-service teachers' geometry attitudes scores and self-efficacy scores towards geometry was also found to be high. The present data are in congruent with the results of Bindak (2004) and Cantürk-Günhan and Başer (2007). In addition, current study revealed that there is a strong positive relationship between pre-service teachers' geometry attitudes and self-efficacy beliefs towards geometry. This result supports earlier researches indicating a relationship between attitudes and self-efficacy beliefs (e.g., Pajares & Miller, 1994; Stramel, J. K., 2010; Usher, 2009). When these results are taken into consideration it can be concluded that recent studies emphasize the importance of affective properties in efficient learning such as self-efficacy beliefs or attitudes towards school subjects. Moreover, it is thought that determining pre-service teachers' attitudes and self-efficacy beliefs towards geometry may help teachers to regulate themselves according to students' needs and to increase students' geometry achievement.

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